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Optical trapping and cooling of microspheres: towards the quantum limit TONGCANG LI, SIMON KHEIFETS, DAVID MEDELLIN, MARK RAIZEN, The University of Texas at Austin — Recently, there has been rapid progress in the field of cooling opto-mechanical systems. Here we propose to use optical tweezers to trap and cool glass microspheres to the quantum ground state, and use the microsphere as a micro-detector operating at the quantum limit. We have successfully trapped glass microspheres in air and in vacuum, and have studied the Brownian motion of single microspheres in air at different pressures with ultrahigh resolution. At short time scales, we observed ballistic Brownian motion. We have measured the instantaneous velocity of Brownian motion successfully for the first time, and verified the energy equipartition theorem of the Brownian motion directly. We are currently working on cooling the center-of-mass motion of glass microspheres in optical tweezers.

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